INTEGRATING CLIMATE CHANGE INTO THE PRE-VOCATIONAL AGRICULTURE CURRICULUM FOR SUSTAINABLE FOOD SECURITY: VIEWS FROM TEACHERS: INSPECTORATE AND CURRICULUM DESIGNERS IN ESWATINI

Vincent C. Asogwa

Department of Agricultural Education & Extension,
University of Eswatini

***Mpendulo Mathenjwa**

Department of Agricultural Education & Extension,
University of Eswatini;

Zanele M. Gule

Department of Agricultural Education & Extension,
University of Eswatini

ABSTRACT

Increasing impacts of Climate Change in Eswatini compelled Government to inform her citizens about its causes, impacts and mitigating measures. Such changes in climate affects mainly farmers and threatens sustainable future food security and the comfort of the younger generation. Hence, this study sought to explore how climate change can be integrated into Pre-Vocational Agriculture Curriculum in secondary schools in Eswatini. Five research questions were answered through a mixed method research design. The population was N=22 and 2 instruments were used and validated by experts. Internal consistency of questionnaire was determined using Cronbach Alpha co-efficient formula, which yielded 0.76. The findings revealed that the major objectives of Pre-Vocational Agriculture curriculum were to enable students acquire and apply basic knowledge and principles of climate change mitigation strategies and to provide students with knowledge on the causes of climate change. The main content of climate change are human activities that facilitate climate change, impact of climate change and meaning of both climate change and global warming. The problem-solving method and field trip were the leading instructional methods. Finally, the objective-type questions and assignments formed primary evaluation techniques of climate change for integration into the curriculum. Recommendations were that the Ministry of Education and Training should integrate the identified objectives and content areas into Pre-Vocational Agriculture curriculum in secondary schools; Schools Agriculture Inspectorate should also organise workshops for Pre-Vocational Agriculture teachers to improve their knowledge on climate change for effective teaching and evaluation of concepts in secondary schools.

Keywords: Curriculum, evaluation techniques, integration, climate change, pre-vocational agriculture.

***CORRESPONDING AUTHOR**: Mpendulo Mathenjwa, Department of Agricultural Education & Extension, University of Eswatini, the Kingdom of Eswatini *mpmatsenjwa@uniswa.sz* Tel.: (+268 76236905)

INTRODUCTION

Recently, the world has become highly interested in producing food not only for consumption purposes but for ensuring its sustainability and availability to every individual, everywhere and every time to ensure food security. The concept of food security has evolved over recent decades and has been gradually enlarged (Berry *et al*., 2015). Initially, food security covered mainly availability of food and food production; later, it was expanded to include explicitly the accessibility to food (physical, economic, and sociocultural), its utilization and the stability of these dimensions. Food and Agriculture Organisation (2008) proposed that food security "exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". FAO (2012) explained that food security is built on four pillars namely: (i) Food availability: sufficient quantities of food available on a consistent basis; (ii) Food access: having sufficient resources to obtain appropriate foods for a nutritious diet; and (iii) Food use: appropriate use based on knowledge of basic nutrition and care; (iv) Stability in food availability, access and utilization. Capone, *et al*., (2014) observed that ending hunger and achieving food security require that food consumption and production systems attain more with less, which encompasses fostering sustainable intensification of food production, encouraging sustainable food consumption, and reducing food losses and waste. This emphasizes the need for sustainable food security.

However, inferring from sustainable development, which is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs (United Nations, 1987); sustainable food security then "exists when all people (old and young), at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life now and in future". Considering the above definition of sustainable food security, one could ask if the Kingdom of Eswatini's food is sustainably secured. There is no doubt that Eswatini could have been sustainably food secured due to the small population which is estimated at 1.2 million, land locking feature, fertile soil with good drainage system, diverse weather conditions for both plants and animals, moderate sloping plains that make irrigation sustainable, and high percentage of the population engaging in agricultural production (Dube, 2009). This, however, is not the case because of the decline in yield and loss of agricultural produce due to climate change. Similarly, Asian Development Bank (2010) found that the three binding constraints to achieving the goal of sustainable food security are stagnating food productivity and production; lack of access to rural finance, infrastructure, technology, markets, and nonfarm income opportunities; and threat of climate change and volatility of food prices. Consequently, FAO recently estimated that globally, a total of 842 million people in 2011–13 (around one in eight people in the world or 12 percent of the global population), were estimated to be suffering from chronic hunger, regularly not meeting their dietary energy

requirements to conduct an active life. Sonnino *et al*. (2013) found that there are four main threats to sustainable food security. They are the degradation and loss of agricultural land; loss of biodiversity; pressure of agriculture on water resources; pollution and resource depletion – all issues that affect climate change, and at the same time are influenced by the dynamics of climate change, which are bound to change the global geography of food production.

Furthermore, it is no news that climate change is one of the global crises facing humanity that has forced many countries of the world to map out policy frameworks and strategies for prevention and reduction of its effects on human, soil, water, animal, and plants. Climate change was recognized as a serious problem by the First World Climate Conference in 1979 (United Nations Environment Programme (UNEP, 2000). It is the periodic modification of the Earth's climate that results from changes in the atmosphere as well as interactions between the atmosphere and various other geologic, chemical, biological, and geographic factors within the Earth system (Encyclopaedia Britannica, 2019). European Union (2019) noted that the impact of climate change is experienced across the EU, and European farming, through changing rainfall patterns, rising temperatures, variability in seasonality and extreme weather events, such as heat waves, droughts, storms, and floods. It has been predicted that by the end of 2035, there would be a 2˚C increase in temperature if nothing is done to address the problem (Stern, 2014). Alawa *et al*., (2014) cautioned that climate change has the potential to damage irreversibly the natural resource base on which agriculture depends on grave consequences for food security.

Evidently, climate change is already affecting the Kingdom of Eswatini and the key sectors of her economy (Swaziland Ministry of Tourism and Environmental Affairs, 2016). Some of the climate change impacts experienced include significant variations in precipitation patterns, higher temperatures and increasing in frequency and intensity of severe weather events such as droughts, floods, and cyclones. These changes negatively affect agricultural yields, biodiversity, forest harvests and availability of clean water. The Eswatini Ministry of Tourism and Environmental Affairs emphasises that bearing the brunt of all the impact of climate change are the majority of rural poor who depend on climate sensitive sectors such as agriculture, forestry and traditional fishing for much of their day-to-day needs. The New Humanitarian (2007) affirms that the Kingdom of Eswatini has always experienced severe thunderstorms and windstorms, but it was not until 2005 that Manzini, in central Eswatini, experienced its first tornado. According to the report, farmers blamed climate change for declining food production. "Climate change is real, and its effects are [clearly visible]," said Emmanuel Dlamini, Director of the National Meteorological Service.

In any case, the government of Eswatini being fully aware of climate change and its adverse effects on humanity and sustainable food security, has been making a concerted effort like other countries of the world to combat climate change and mitigate its effects. For instance, the national policy framework which includes the 1999 National Development Strategy (NDS) with long-term development Vision 2022 and the 1997 Swaziland Environment Action Plan (SEAP) were established (International Institute for Environment and Development (IIED) in partnership with European Parliamentarians for Africa (AWEPA), 2011). Disaster Risk Management started formally in Eswatini with the National Disaster Task Force (NDTF), which was

established in response to the 1991/92 drought. In 1999, Government prepared a National Disaster Management Policy and in 2000 a Swaziland National Disaster Management Plan. In 2006, a National Disaster Management Act came into effect followed in 2008 by the Swaziland Disaster Risk Reduction National Action Plan (NAP) 2008-2015. In addition, Swaziland policy framework was established in response to its national Parliamentary role and relationship to effectively address global environmental issues, of which the most relevant in this context is climate change.

At the national level, climate change challenges are addressed around the legal and institutional framework established around disaster management. Nevertheless, it could be assumed that little or nothing has been done at institutional level especially in junior secondary and vocational schools concerning their curriculum in addressing this dragon headed global issue. This could be why Swaziland National Assessment Report (2019) emphasized that the Kingdom of Eswatini is able to record a large number of successes in its pursuit of sustainable development and the implementation of Agenda 21, but identified key threats to sustainable development in the Kingdom of Eswatini, such as loss of biodiversity and increasing threats to existing ecosystems (veld burning, overgrazing, demand for fuel wood, land conversion and expansion of agricultural schemes); global atmospheric and climate change and increased susceptibility to floods and droughts; threats resulting from water shortage for both human and environmental requirements; and land issues, particularly equitable access to land and natural resources, but including land degradation. It is unfortunate that despite the formulation of policies and physical efforts made by the Government towards agricultural production and climate change, there is fear that the battle with climate change may not be sustainable for sustainable food security in the country, until it is mainstreamed into the thinking initiative of the future generation. Undoubtedly, the researchers are convinced that the integration of climate change into the curriculum of Pre-vocational Agriculture could, to a remarkably high unimaginable degree, tackle most of the threats especially climate change for sustainable food security in Eswatini.

There are a variety of definitions in relation to the term “curriculum”, probably because of divided perceptions of stakeholders like students, educators, researchers, administrators, evaluators with their own agenda of emphasis in educational discourse (Wen Su, 2012). Curriculum, as a plan of instruction, is a sustained process of teaching and learning” with a specific focus on content and the process of teaching and learning (Pratt, 1994). Marsh (1997) posits curriculum as “an interrelated set of plans and experiences which a student completes under the guidance of the school”. As a document, it is an outline of a course programme that is written on a piece of paper (Brady, 1995). It is associated with the official written programmes of study published by ministries or departments of education, local authorities or boards of education, and commercial firms or teams of educational specialists working on specially funded projects” (Barrow & Milburn, 1990). This view of the visual written document attached to curriculum derives from the need that, particularly in the phases of curriculum development and implementation, a written form must be made to include a statement of objectives, content, method, and assessment (Wen Su, 2012). A critical analysis of the curriculum of Pre-vocational Agriculture in Eswatini shows that there is little or no trace of emphasis as a topic of study in any subject. Meanwhile, during the analysis, the researchers observed that Agriculture is the closest subject relating to climate change that can accommodate it since there are already some common concepts such as

weather and agriculture, soil erosion and management, agricultural practices that increase or reduce global warming, dissertation, and environmental degradation.

Pre-vocational Education programme is a separate entity from the Eswatini General Certificate of Secondary Education (EGCSE). It started as a pilot project in some sixteen (16) selected schools throughout the country, four (4) in each region. It is offered at the senior secondary level. Learners who opt for the programme do the following: all general core subjects, prevocational core, comprising Information Technology (IT) and Entrepreneurship (EP) and choose one area of specialization from a wide range of practical subjects that include agriculture, business studies, home economics and technical studies. The programme was designed to provide learners with survival skills that will open doors for continuing to post-secondary education, finding a job in either the private sector or public sector and most importantly starting a business enterprise. The programme is accredited by the Examination Council of Swaziland (ECOS) and the Directorate of Industrial Vocational Training (DIVT) but the curriculum of agriculture is lacking in climate change.

Having identified this gap, the researchers were concerned with the objectives, contents, methods of instruction and evaluation of climate change objectives in the curriculum. This would enable them to communicate with the Ministry of Education and make effective suggestions on the agriculture curriculum in Pre-vocational Agriculture for sustainable effort towards climate change in the country. In response to that, the study adopted Tyler's (1950) Model of curriculum development or integration in Education to determine proper information for integrating climate change into the curriculum of Pre-vocational Agriculture in senior secondary schools for sustainable food security in Eswatini.

Statement of problem

There is no doubt that the Kingdom of Eswatini would have been judged as a food sufficient nation due to her increased agricultural activities, agricultural friendly environment, small population, and favourable agricultural policies, but just like other nations of the world, it is highly threatened by climate change. This is geometrically affecting both animal and crop yields in various degrees each year without tantamount mitigating measures despite government's policy formulations, amendments and implementation at different ministries, parastatal, and institutions since 2010. The government has through several community-based campaigns and electronic media informed her citizens of the existence of climate change and its effects, causes and predisposing factors to be avoided, yet the impact on the nation especially on agriculture is increasing at an alarming rate. Besides, a gap will exist between what the adults are doing now to mitigate the menace of climate change and what children will do in future for sustainability if they are not well informed since government spends heavily and may not continue such campaign strategy unendingly. In any case, for sustainability of government's effort, there is a need to create a channel on how to continuously educate and sustainably involve children and youth in climate change mitigation strategies in Eswatini. Hence, the need to integrate climate change issues into the agriculture curriculum in junior secondary schools to inculcate climate change awareness into the system, life value and thinking of every child in Eswatini for sustainable effort towards climate change.

Furthermore, a focused contextual analysis of the curriculum of junior secondary school in Eswatini by the researchers shows that there is integration of Information and Communication Technology (ICT) (Nchunge *et al*., 2013) but little or no climate change issue present or emphasized in any of the subjects offered to the students at that level currently. It was also observed that agriculture as a subject contained climate change related issues such as plant growth and environment, crop production, soil conservation, forestry, pasture management, animal husbandry but had no direct bearing on the meaning, effects, causes, preventive and control measure, practices that increase or reduce global warming and environmental degradation, among others. This implies that agriculture in junior secondary school has some concepts related to climate change and can accommodate climate change issues if well integrated. The concern however, is that if the Ministry of Education in Eswatini could integrate climate change issues into the curriculum, what could be the objectives, contents, methods of instruction and evaluation as recommended by Tyler's Model of curriculum development or integration in Education? It was in a bid to provide answers to these questions that the researchers decided to embark on this study. The purpose of the study was to explore how climate change can be integrated into the agriculture curriculum in junior secondary schools for sustainable food security in Eswatini. Specifically, the study sought to identify the demographic variables of the respondents, objectives of climate change, contents of climate change, instructional methods of climate change and evaluation techniques of climate change for integration into the Pre-vocational Agriculture curriculum in junior secondary schools in Eswatini.

Significance of the Study

It was envisaged that the study could expose teachers of agriculture to the meaning, causes and effects, predisposing, preventive and mitigating measures of climate change. The teachers could educate the students and engage them in certain operations for combatting climate change within and outside the school environment. Stanford University, California (2019) noted that such curriculum leads students through a progression of understanding climate change. It begins with students thinking about climate and weather, and the local impact of sea-level rise due to climate change in the first lesson. This is done for purposes of hooking the students to the unit, getting them to think about their own connection to climate change. In order to understand how excess carbon dioxide is rapidly changing the climate, students first learn about the Earth's energy budget and then focus on greenhouse gases. Besides, the students in Eswatini could extend such operations and sustain their participation in mitigating climate change outside the school environment for their benefit and that of the community. The parents could also emulate from their children for continuous and sustained effort towards climate change mitigation and food security. This would in turn save government the cost of regular community-based campaigns and media education on climate change for sustainable food security and healthy living in the country. It would buttress the view by Dlamini (2019) that knowing more about the climate system is of utmost importance not only to satisfy our scientific curiosity but also to help us prepare for any threats and risks that may arise in the natural environment. Effective use of any resource needs detailed information to aid planning, strategizing and risk management. Climate change information in our case may help us achieve that, and be the getaway to increased adaptive capacity and climate resilience. Lastly, this study could make government's effort against climate change sustainable since all the children

that passes through the curriculum will be exposed to it and runs through generations. Future researchers could also use this study as a form of reference on climate issues and curriculum development in Eswatini.

Theoretical framework

This study was anchored on Tyler (1945) model of curriculum development. Tyler approached curriculum development by asking four basic questions, which are, what educational purposes should the curriculum seek to attain? What educational experiences can be provided that are likely to attain these purposes? How can these educational experiences be effectively organized? How can we evaluate whether these selected purposes have been attained? (Bhola, 1990). The answers to these four basic questions led to the four steps in curriculum development as advocated by Tyler (1949) which include the selection of objectives, selection of the means of attaining these objectives (learning experiences), organization of these means (methods) and evaluation of the achievement of the selected objectives. The model focuses on formulating a statement of educational objectives, classifying the objectives into major types, defining and refining each of these types of objectives in terms of behaviours, identifying a situation in which students can be expected to display these types of behavior, selecting and trying promising methods for obtaining evidence, regarding each type of objective, selecting on the basis of preliminary trials the more promising appraisal method for further interpreting and using the results (Tyler, 1942).

Contextually, the first stage is the selection of the educational purposes - aims, goals and objectives. The aims are broad expectations and accomplished in a long time; they reflect all the experiences provided in the curriculum. Goals are tied to specific subjects or group of content within the curriculum while objectives describe more specific outcomes because of lessons or instructions delivered in a classroom. The implication of this stage of curriculum development process to the study is that it sought to determine the specific objectives of climate change for integration into the agriculture curriculum in junior senior secondary school. The second stage deals with selection of learning experiences. After determining objectives, the next step in curriculum development based on Tyler's view is selection of learning experiences. Learning experiences are activities, which the learner engages in or interacts with leading to a desirable change in behaviour. The learning experiences is what is taught (subject matter) to learners which must be valid, significant, interesting, and learnable. In this stage of curriculum development, the planner carefully selects those activities that will help accomplish stated objectives otherwise called the content.

The implication of this stage in curriculum development process is that it enabled the researchers to select activities or content, which the students would be exposed to help achieve the determined objectives of climate change integration into the curriculum. Thirdly is the organization and integration of experiences. In this stage, Tyler's model involves the arrangement of learning experiences into instructional methods that leads to accomplishment of the learning objectives. In this study, the identified objectives and content of climate change issues were organized systematically into methods of teaching to aid learning of climate change. The fourth stage is the evaluation of the achievement of the selected objectives. At this stage of curriculum development, ways of determining the extent to which the objectives of the study have been accomplished by learners are identified. In this study, same principle by Tyler was adopted by the researcher

to identify evaluation techniques which will suitably measure the determined objectives of climate change for integration into the curriculum of Agriculture. In summary, Tyler (1949) suggested that his model could be used for curriculum development at any level; it therefore forming a vital tool for the researcher in identifying curriculum components such as objectives, content, pedagogy and evaluation techniques of climate change for integration into the curriculum of agriculture in junior secondary schools in Eswatini.

Research Questions

1. What are the demographic variables of the respondents on integrating climate change into the Pre-Vocational Agriculture Curriculum in Eswatini?
2. What are the objectives of climate change for integration into the Pre-Vocational Agriculture Curriculum in Eswatini?
3. Which content of climate change can be integrated into the Pre-Vocational Agriculture Curriculum in Eswatini?
4. What are the instructional methods of climate change for integration into the Pre-Vocational Agriculture Curriculum in Eswatini?
5. What are the evaluation techniques of climate change for integration into the curriculum of Pre-Vocational Agriculture in Eswatini?

METHODOLOGY

The study adopted the mixed methods research and employed the explanatory sequential design. Five research questions were raised and answered while four null hypotheses were formulated and tested. The population for the study was N=22 (prevocational agriculture teachers, prevocational agriculture inspectorate and curriculum designers). There were 16 prevocational agriculture teachers, 4 agriculture inspectors from the Ministry of Education and Training (MoET) and 2 agriculture curriculum designers from the National Curriculum Centre (NCC). The study used census-sampling technique. The study adopted both quantitative and qualitative approaches with two instruments for data collection, respectively. For quantitative data, a 56-item closed ended structured questionnaire titled: Climate Change Agriculture Curriculum Integration Questionnaire (CCACIQ) was developed by the researchers. The instrument was structured on 4-point response options of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) with corresponding value of 1, 2, 3, and 4 respectively. For qualitative data, a 4-sentence interview schedule named as follows: Climate Change Agriculture Curriculum Integration Interview Schedule (CCACIIS) was developed the by researchers from literature. The CCACIIS had 4 open-ended questions based on the objectives of the study. Both instruments had part B, which solicited biodata of the respondents. The instrument was face validated by three experts: one from the Department of Agricultural Education & Extension, one from the Department of Science Education (measurement and evaluation unit), University of Eswatini and the other from the Ministry Environment and Tourism, Eswatini.

The internal consistency of the questionnaire was determined using Cronbach Alpha co-efficient formula, which yielded 0.76 for 25 copies of the questionnaire retrieved; this means that the CCACIQ items were excellent for the study (George & Mallery, 2003). The CCACIQ was hand delivered to the 16 prevocational teachers in all the prevocational schools. In all, 16 correctly checked copies of the CCACIQ were retrieved from the respondents, indicating a retrieval rate of 100%. An interview was organized for the purposively selected 4 agriculture inspectors and 2 agriculture curriculum designers using CCACIIS to obtain more information on what are needed to be included for validity of the study. All the copies correctly responded to, returned and collated were used for data analysis.

Arithmetic mean was used to answer research questions and t-test statistic was used to test the null hypotheses at .05 level of significance. The decision was that any item with a mean value of 2.50 or above was regarded as disagreed while any item with a mean value of 2.49 or below was regarded as agreed. Similarly, the hypothesis of no significant difference was rejected where the p-value was less than the alpha-value of .05 but not rejected where the p-value was greater than or equal to the alpha-value of .05. All quantitative statistical analyses were performed with Statistical Package for Social Sciences (SPSS) software. The data from CCACIIS were transcribed and analyzed thematically. Furthermore, direct quotes from participants were used to substantiate the themes that emerged from the analysis of qualitative data.

Ethical considerations

The researchers sought permission from the Ministry of Education and Training to conduct this study. An introductory letter that explained the purpose and the rights of the participants was attached to the questionnaire and interview schedule to obtain full consent of the participants prior to responding. The respondents were assured of their adequate level of dignity, protection, confidentiality, and anonymity in participating in the study since the instruments did not require information that could lead to tracing back the individual respondent during or after the study. Participation in the study was voluntary and the respondents had every right to withdraw from the study at any point. The data collected were analysed and interpreted with a high level of honesty and transparency and would not be used other than the purpose it was meant for. The researchers maintained a satisfactory level of objectivity in discussing the results of the study. There was no conflict of interest among the researchers or with any party, as this research was not funded by any organization except by the researchers.

RESULTS

The results of the study were presented in Tables 1 to 4. The descriptive statistics of biodata of the respondents of the study are presented in Figure 1. All the respondents for the CCACIQ were prevocational agriculture teachers and half of them were females. Most (75%) prevocational agriculture teachers had less than 9 years of teaching experience as indicated on Figure 1.

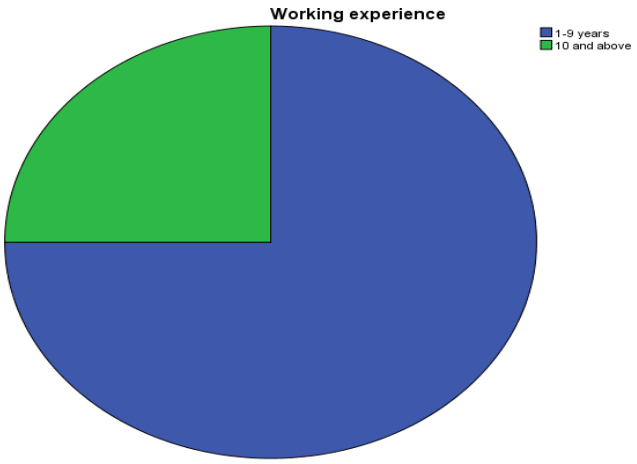

Figure 1: **Pie Chart showing the working experience of prevocational agriculture teachers.**

Three participants were interviewed using the CCACAIIS. Two of the participants were prevocational agriculture inspectors and one was a prevocational agriculture curriculum designer. All the interviewees had more than two years in their current positions. All the participants had more than 5 years teaching experience in prevocational agriculture before being promoted to their current position. Two of them were females and one was a male.

Table 1: *Objectives of climate change for integration into the Pre-Vocational Agriculture Curriculum in Eswatini*

S/N	Items on Objectives	Mean	Std. Deviation	Decision
1	Enable students to acquire basic knowledge and apply the principles of CC mitigation strategies	1.00	.00	Agreed
2	Provide students with the knowledge on the causes	1.00	.00	Agreed
3	Enable students to acquire basic knowledge and consciousness of climate change in their environment	1.25	.45	Agreed
4	Imbibe students on principles of CC mitigation strategies	1.31	.60	Agreed
5	Equip students with the knowledge of the elements of climate change	1.31	.48	Agreed
6	Assist students analyze the impact of CC on agricultural, environmental, biological, and social systems	1.38	.62	Agreed
7	Assist students identify and engage in CC mitigating practices	1.50	.52	Agreed
8	Expose students to climate change mitigation and adaptation strategies	1.75	.58	Agreed
9	Provide students with the knowledge of natural factors facilitating CC	2.00	.63	Agreed
10	Enable students to identify various sources of evidence used to chart climate	2.06	.68	Agreed

11	Assist students analyze data to justify claims relating to climate, CC and mitigations	2.06	.77	Agreed

As shown in Table 1, prevocational agriculture teachers agreed (1.00 ≤ M ≤ 2.06) to all listed objectives of climate change to be integrated in the prevocational agriculture curriculum in Eswatini. All prevocational agriculture teachers' responses were uniform (SD = .00) that climate change should be integrated to the prevocational agriculture curriculum to enable students to acquire basic knowledge and apply the principles of climate change mitigation strategies and provide students with the knowledge on the causes and human activities that facilitate climate change.

The qualitative data indicated that climate change should be integrated into the prevocational agriculture curriculum to make the curriculum more relevant and responsive to the needs of students as they embark on farming as an enterprise. One participant said, "to generally make the students understand the impact of climate change in agriculture".

Table 2: *Content of climate change for integration into the Pre-Vocational Agriculture Curriculum in Eswatini*

S/N	Items on Contents	Mean	Std. Deviation	Decision
1	Causes and human activities that facilitate CC	1.00	.00	Agreed
2	Impact of CC	1.00	.00	Agreed
3	Meaning of climate change and global warming	1.00	.00	Agreed
4	Elements of CC	1.19	.40	Agreed
5	Climate change mitigation	1.38	.50	Agreed
6	Principles of CC mitigation strategies	1.56	.73	Agreed
7	Application of the principles of CC	1.75	.68	Agreed
8	Natural factors facilitating CC	1.75	.68	Agreed
9	Identification and engagement of students in CC	1.81	.66	Agreed
10	Analysis of data and evidence	2.19	.66	Agreed
11	various source of evidence to chart CC	2.25	.68	Agreed

As indicated in Table 2, all prevocational agriculture teachers agreed (1.00 ≤ M ≤ 2.25) that the 11 items constituting the content of climate change be integrated into the pre-vocational agriculture curriculum. Prevocational agriculture teachers' responses to causes and human activities that facilitate climate change, impact of climate change, and meaning of climate change and global warming were uniform (S.D = .00). All the 11 aspects of climate change content can be integrated into the prevocational agriculture curriculum. A theme that emerged from the explanation of the content for climate change integration was that the content must be integrated based on relevance, appropriateness, and impact on the subject and subsequent enterprises thereof. The participants felt that prevocational agriculture learners must be able to differentiate between climate change and global warming. One participant even said, "it is important for prevocational agriculture learners to understand the causes and human activities that facilitate CG to be in a position to

develop mitigation strategies". Other participants further articulated that the content must expose prevocational agriculture learners to the impact of CG, hence the need for learners to identify sources of evidence for CG and how to analyze information from such sources to substantiate CG issues.

Table 3: *Instructional methods for climate change in the Prevocational Agriculture Curriculum in Eswatini*

S/N	Items on Instructional methods	Mean	Std. Deviation	Decision
1	Problem solving method	1.38	.50	Agreed
2	Field trip	1.38	.50	Agreed
3	Lecture method	1.56	.63	Agreed
3	Discussion method	1.63	.50	Agreed
4	Project method	1.63	.89	Agreed
5	Demonstration	1.69	.79	Agreed
6	Guided discovery	1.81	.83	Agreed
7	Visual aided instruction	1.87	.64	Agreed
8	Experimental method	1.94	1.06	Agreed
9	Supervised practice	2.00	.53	Agreed
10	Essay type question	2.00	.73	Agreed
11	Audio-visual aided instruction	2.06	.68	Agreed
12	Blended instruction	2.13	.96	Agreed
13	Audio aided instruction	2.27	.70	Agreed
14	Concept mapping	2.33	.82	Agreed
15	Role playing	2.47	.83	Agreed

As shown in Table 3, the respondents agreed ($1.38 \leq M \leq 2.47$) that the 16 instructional methods can be used in teaching content on climate change in the prevocational agriculture curriculum. Prevocational agriculture teachers' responses were not uniform as indicated by the standard deviations that ranged from .50 to 1.06 in the listed instructional methods. All the sixteen instructional methods are fit for teaching content on climate change in the prevocational agriculture curriculum.

The interviews uncovered that the suitability of instructional methods is influenced by the practicality of methods and the ability to develop problem-solving skills among learners. One participant said, "field trips are commonly used since they allow learners to physically observe the effects of CG or real impact of CG". Apart from field trips, the use of problem-solving skills was appropriate since it enabled the learners to interrogate issues of CG and come up with solutions applicable to their context. The participants further explained that lack of uniformity among prevocational agriculture teachers in the choices of instructional methods was influenced by different socio-economic factors experienced by prevocational school. One participant illuminated this issue by saying, "no two schools are the same moreover the socio-economic status and intellectual capabilities of students differ from school to school".

As shown in Table 4, prevocational agriculture teachers disagreed on the use of anecdotal records and socio-metric techniques as modes of evaluation in the pre-vocational agriculture curriculum. The respondents agreed that sixteen of the listed evaluation methods could be employed in prevocational agriculture. There was greater variability (SD = 1.11; 1.01; and 1.00) in the responses of prevocational agriculture teachers regarding the use of self-evaluation, examinations and quizzes, and performance type tests, respectively. According to the prevocational agriculture teachers, most (sixteen of the eighteen) of the evaluation methods were appropriate for use on climate change content.

It was gathered from the interviews that the plausible explanations for the choice of using class works, giving assignments, and objective-type of questions as evaluation techniques appropriate for use in CG content were based on the ability of the technique to foster learners to read extensively on specific aspect using different sources and immediacy of showing understanding of taught concept. One participant expounded that, “evaluation techniques were chosen because they enable learners to focus on specific aspects of climate change and even elaborate on that particular concept”. Furthermore, one participant explained that the non-use of anecdotal records is mainly due to inability of teachers to tap into lived experiences of learners. Interviewee one said, “we still have a challenge with our agriculture teachers for fail to relate subject content to the day-to-day farming activities of learners”.

Table 4: *Evaluation techniques of climate change for integration into the Pre-Vocational Agriculture Curriculum in Eswatini*

S/N	Items on Evaluation Techniques	Mean	Std. Deviation	Decision
1	Assignments	1.38	.81	Agreed
2	Objective type questions	1.50	.52	Agreed
3	Class works	1.69	.48	Agreed
4	Exams and quizzes	1.69	1.01	Agreed
5	Supervised practical examinations	1.75	.77	Agreed
6	Performance type tests	1.94	1.00	Agreed
7	Essay type questions	2.00	.73	Agreed
8	Questioning	2.06	.44	Agreed
9	Oral examinations	2.07	.96	Agreed
10	Observation	2.13	.96	Agreed
11	Questionnaire	2.19	.98	Agreed
12	Checklists	2.25	.77	Agreed
13	Interview	2.31	.95	Agreed
14	Self-evaluation	2.33	1.11	Agreed
15	Online examination	2.44	.81	Agreed
16	Subjective questioning	2.44	.51	Agreed
17	Socio-metric technique	2.79	.70	Disagreed
18	Anecdotal records	2.80	.86	Disagreed

DISCUSSIONS OF RESULTS

Results of the study revealed that pre-vocational agriculture teachers were of the idea that climate change should be integrated in the prevocational agriculture curriculum in Eswatini. The consensus was that the integration of climate change into the curriculum would enable students to acquire the basic knowledge of the different elements of climate change, its causes, impacts and mitigation strategies. Such awareness and knowledge would help them apply such principles in future by participating in mitigating climate change outside the school environment for their benefit and that of the community. This is in support of the view by Dlamini (2019) that knowing more about the climate system does not only satisfy our scientific curiosity, but also helps us prepare for any threats and risks that may arise in the natural environment. This therefore means that if education is going to contribute to the current challenge on weather variations, integrating climate change into the curriculum becomes necessary to ensure that prevocational agriculture students at the senior secondary school level are abreast with the climate change issues including mitigation and adaptation strategies as a tool for combating the impacts. In addition, the Intergovernmental Panel on Climate Change (2007), further highlighted that children in developing countries, like those in the

Kingdom of Eswatini, are the most vulnerable and have inadequate awareness and coping capacity (Selim, 2012). This stresses the need to respond to their needs and quality education must be the channel to make all girls and boys more resilient to the impacts of climate change (Selim, 2012).

The results of the study in Table 2 revealed the specific content of climate change to be integrated in the prevocational agriculture curriculum. These include amongst others, sources of evidence to chart climate change, analysis of data and evidence, identification, and engagement of students in climate change, application of principles, factors, climate change mitigation, elements of climate change, causes and human activities facilitating climate change, impact of climate change and meaning of climate change and global warming. The findings of the study were in line with the findings of Chikaire *et al.* (2012) that the areas of climate change that could be integrated into the curriculum are the introduction to climate change, global warming, agro-biodiversity, bio-fuels, adaptation strategies, mitigation strategies and global policy issues among others.

The findings were also in consonant with the findings of Orusha *et al.* (2012) in a study on integrating climate change issues into agricultural education teaching and learning in Nigeria in which it was found that the curriculum content on climate change could be based on agro-bio-diversity, biofuels, mitigation strategies and global policy issues, except that agro -bio-diversity, bio -fuels and global policy issues, which were not included in this study. The results emphasize a significant point made by Ikehi *et al.* (2014) that the curriculum content should be designed in such a way that it equips the students with the necessary knowledge, skills, and attitudes to tackle this global issue. One of the steps necessary to achieve this is the integration of climate change and its related matters in the curriculum, especially at the senior secondary school level to create early awareness and expose students to effects, causes, and mitigation or adaptation strategies to enhance their capacity as well as prepare them for the future climate related challenges in the society (Ikehi et al., 2014).

The result of the study in Table 3 revealed that the iinstructional methods that can be used in teaching content on climate change in the prevocational agriculture curriculum were role-playing, concept mapping, audio aided instruction, blended instruction, audio visual aided instruction, supervised practice, and essay type questions, among others. The findings of the study agreed with the findings by Oluwatobi *et al*. (2019) in their study, which looked at Integrating Climate Change Issues in the Upper Basic Schools of the Gambia. The study revealed that appropriate methods for teaching the meaning of climate change included child-centred, resource-based learning, demonstration method, discussion method, field trip, excursion and site seeing, role play/modelling/drama, project work or activity, experimental/exploration, and research for knowledge construction. The results of the research were also in consonant with the findings of Oversby (2015) in which innovative pedagogical methods, such as provocative discussion statements, generation of questions, collaborative games, which initiates engagement of learners, provoking student-relevant questions, considering instructions in the light of learners' prior knowledge, and their skills of independent learning were considered the most appropriate methods for teaching climate change education.

Table 4 results revealed that the evaluation techniques of climate change that can be used in the prevocational agriculture curriculum are subjective questioning, online examination, self-evaluation, interview, checklists, questionnaire, observation, oral examinations, and questions, among others. This is in line with the findings of Barnett, Parry and Coate (2001) and Krathwohl (2002) where they stated that in a climate change curriculum, assessment should gauge higher order cognitive skills and concepts, affective, and skill-based knowledge as well as factual knowledge. These may include the following, among others, group presentations, essay or in class debates, reflective piece, short answer questions and placement project. The results of the analysis also revealed that anecdotal records and socio-metric techniques are not the appropriate methods for teaching the themes of climate change. The findings of Barnett, Parry and Coate (2001) and Krathwohl (2002) helped to validate the current findings on integration of climate change into the prevocational agriculture curriculum at secondary school.

CONCLUSION

To inculcate climate change awareness into the system, life value and thinking of every child in Eswatini for sustainable effort towards climate change, the integration of climate change into the prevocational agriculture curriculum in senior secondary schools becomes imperative. The students of prevocational agriculture need to be acquainted with the concept of climate change, causes, effects and mitigation/adaptation strategies as such learned information could be disseminated to other members of the society. In addition, for this critical information to be learnt, proper methods of instruction and evaluation should be adopted and used by prevocational agriculture teachers. This study has therefore identified the objectives of climate change, the contents, methods of teaching and evaluation of climate change required for integration into the prevocational agriculture school curriculum in secondary schools of Eswatini. As a result, enhancing the students' knowledge base would go a long way in enhancing efforts by the country to combating climate change and mitigate its effects.

Recommendations

1) The identified objectives and content areas of climate change should be integrated into the curriculum of prevocational agriculture in secondary schools in Eswatini by the Ministry of Education and Training with the help of the National Curriculum Centre (NCC) and the Schools Agriculture Panel to keep the students abreast with the challenges and mitigation strategies of climate change.

2) Workshops for the teachers of prevocational agriculture in secondary schools in Eswatini should be organized by the Schools Agriculture Inspectorate to upgrade their knowledge on climate change to make them competent as well impart them with knowledge on how to effectively teach and evaluate climate change concepts.

REFERENCES

Alawa, D.A., Asogwa, V.C. & Ikelusi, C.O. (2014) Measures for Mitigating the Effects of Climate Change on Crop Production in Nigeria. *American Journal of Climate Change, Vol 3, 161-168.* http://dx.doi.org/10.4236/ajcc.2014.32015

Asian Development Bank (2010). Operational Plan for Sustainable Food Security in Asia and the Pacific. Asia: Philippines.

Barnett R., Parry G &Coate K. (2001). Conceptualising curriculum change. Teach High Educ 2001; 6. 435-49.

Barrow, R., & Milburn, G. (1990). A critical dictionary of educational concepts. New York: Harvester Wheatsheaf.

Berry, E. M; Dernini, S; Burlingame, B; Meybeck, A. & Conforti, P. (2015). Food security and sustainability: can one exist without the other? Public Health Nutrition: page 1 of 10 doi:10.1017/S136898001500021X.

Bhola, H.S. (1990). Evaluating literacy for development; project programmes and campaigns, Germany The United Nations Educational, Scientific and Cultural Organization (UNESCO), Institute for education and German foundation.

Brady, L. (1995). Curriculum development. Sydney: Prentice Hall.

Capone, R; Bilali, H. E; Debs, P; Cardone, G. & Driouech, N. (2014). Food System Sustainability and Food Security: Connecting the Dots. *Journal of Food Security* Vol 2, No.1, 13-22 Available online at http://pubs.sciepub.com/jfs/2/1/2. DOI:10.12691/jfs-2-1-2.

Dlamini, E. (2019). In Focus: Climate A Resource Worth Preserving. In Climate Action Eswatini. Ministry of Tourism and Environmental Affairs, Climate Change Unit, Mbabane Vol 1, No. 2.

Dube, M. M. (2009). Strategies for addressing environmental education: Nurturing actions towards a sustainable future. In M. Mlipha (Ed) (2009). Actions towards a sustainable future.16-26.

FAO (2008). Special Programme on Food Security. Rome: Food and Agriculture Organization. http://www.fao.org/spfs/en/ [accessed May 17 2009]

FAO, Towards the Future We Want: End hunger and make the transition to sustainable agricultural and food systems. Food and Agriculture Organization (FAO), Rome. 2012d. Available online at: http://www.fao.org/docrep/015/an894e/an894e00.pdf.

George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon.

Krathwohl,. D. R (2002). A revision of bloom's taxonomy: an overview. Theory Pract 2002.41.212.

Marsh, C. J. (ed.) (1997). Perspectives: Key concepts for understanding curriculum 1. London & Washington, D.C.: The Falmer Press.

Ministry of Tourism and Environmental Affairs (2016). National Climate Change Policy. Retrieved from https://info.undp.org/docs/pdc/Documents/SWZ/Swaziland%20Climate on 30/12/2019.

Nchunge, D. M., Sakwa, M., & Mwangi, W. (2013). Assessment of ICT infrastructure on ICT adoption in educational institutions: A descriptive survey of secondary schools in Kiambu County Kenya. Journal of Computer Science and Information Technology. 32-45.

Pratt, D. (1994). Curriculum planning: A handbook for professionals. Fort Worth: Harcourt Brace College Publishers.

Sonnino, R., Faus, A. N., & Maggio, A. (2013). Sustainable Food Security: An Emerging Research and Policy Agenda. *International Journal of Soc. of Agr. & Food. Vol 21, No.1.173–188*.

Stanford University, Standford. Califonia (2019). Climate Change Education. Retrieved from https://earth.stanford.edu/climate-change-ed/curriculum/high on 6/01/2020.

Stern, N. (2014) Economics of Climate Change: A Review. www.hmtreasury.gove.uk.independent-review-economic-climate-change/sterm-review-report.fm.

Tyler, R.W. (1949). Basic Principles of Curriculum and Instruction. Chicago University of Chicago Press.

United Nations (1987) Our Common Future. Report of the World Commission on Environment and Development. Geneva: UN.

United Nations Environment Programme (UNEP)(2000).Climate Change Information Sheet 17. Retrieved from https://unfccc.int/cop3/fccc/climate/fact17.htm on 30/12/2019.

Wen Su, S. (2012). The Various Concepts of Curriculum and the Factors Involved in Curricula-making. *Journal of Language Teaching and Research* Vol 3, No 1.153-158.